Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1131
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1131*
Original Research Article

REVERSIBILITY OF COMPLETE HEART BLOCK AFTER ACUTE ANTERIOR WALL MI

KHAN MA[*1], PERVEZ N[1], REHMAN FU[1], KHAN AG[1], HASHIM M[1], BARI SA[1], QADEER A[1], KAKAR SU[2]

[1]Department of Cardiology, Civil Hospital, Quetta, Pakistan
[2]Department of Health, Balochistan Institute of Psychiatry and Behavioural Sciences, Quetta, Pakistan
**Corresponding author`s email address: affo.entertainer.007@gmail.com*

(Received, 14th June 2024, Revised 10th September 2024, Published 23rd September 2024)

Abstract: *Acute myocardial infarction (MI) can result in varying degrees of heart block, most commonly in inferior wall MI. Identifying the reversibility of complete heart block (CHB) is crucial for guiding clinical management, particularly in determining the need for temporary or permanent pacemaker implantation.* ***Objective:*** *To determine the frequency of reversibility of complete heart block in patients presenting with acute myocardial infarction at Bolan Medical Complex, Quetta.* ***Methods:*** *This cross-sectional study was conducted at Bolan Medical Complex, Quetta, from March 2022 to June 2023. A total of 100 patients aged 18–65 years presenting with syncope and atypical chest pain were included. All patients underwent coronary angiography to identify ischemic causes of bradyarrhythmias. Temporary pacemaker dependency was monitored for two weeks, and permanent pacemaker implantation was performed if necessary. Data on demographic and clinical characteristics were collected and analyzed using SPSS version 22.0. Descriptive statistics were calculated, and the association between heart block reversibility and clinical variables was assessed using the Chi-square test, with $p \leq 0.05$ considered significant.* ***Results:*** *The mean age of the patients was 52.5 ± 14.8 years, with 60% male and 40% female patients. The prevalence of diabetes, hypertension, and smoking was 40%, 55%, and 43%, respectively. CHB occurred in 7% of patients aged 16-35 years and 8% in those aged 36-65 years. The overall reversibility rate of CHB was 48%. A statistically significant association ($p < 0.05$) was found between second-degree atrioventricular (AV) block and CHB in relation to reversibility.* ***Conclusion:*** *Complete heart block in patients with acute myocardial infarction is often reversible, particularly in those with mild coronary artery disease. Temporary pacemaker use should be considered before deciding on permanent pacemaker implantation to allow time for potential spontaneous recovery.*

Keywords: Myocardial Infarction, Heart Block, Atrioventricular Block, Temporary Pacemaker, Coronary Artery Disease, Reversibility

Introduction

Acute myocardial infarction (AMI) is one of the leading causes of morbidity and mortality globally, contributing significantly to cardiovascular disease burden. It is frequently complicated by conduction disturbances, particularly atrioventricular (AV) block, which occurs in approximately 3-7% of AMI patients (1). The incidence of AV block is notably higher in cases of inferior wall myocardial infarction due to ischemic involvement of the atrioventricular node (2). While AV block complicating AMI can have serious outcomes, including bradyarrhythmias, cardiogenic shock, and increased mortality, not all blocks are permanent (3).

Inferior wall AMI often presents with reversible AV block due to ischemia-induced dysfunction of the AV node, which may resolve with medical therapy or reperfusion (4). In contrast, anterior wall myocardial infarction, which involves more extensive septal necrosis, is associated with more severe, often irreversible, conduction disturbances (5). This makes it crucial to determine whether the heart block will resolve spontaneously, particularly when deciding on the need for permanent pacemaker (PPM) implantation.

Current guidelines advocate for delaying the installation of a permanent pacemaker in AMI patients with heart block to allow time for potential recovery, as up to 50% of heart blocks in these cases may resolve within a few days of treatment (6). The use of temporary pacemakers (TPM) provides a bridge, allowing for observation while ensuring patient safety (7).

This study aims to determine the frequency of reversibility of complete heart block in patients with acute myocardial infarction at Bolan Medical Complex, Quetta, and to offer insight into the timing and necessity of permanent pacemaker therapy in this population.

Methodology

This study was designed as a cross-sectional observational study conducted at the Bolan Medical Complex, Quetta, Pakistan, from March 2022 to June 2023. The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Institutional Review Board (IRB) of the hospital.

The study population consisted of adult patients aged 18-65 years, presenting with symptoms of acute myocardial infarction (AMI) and concurrent heart block. A sample size of 100 patients was determined using the prevalence-based formula for cross-sectional studies, with a 95% confidence interval and 5% margin of error. Consecutive non-probability sampling was used to recruit eligible patients admitted to the emergency department during the study period.

[Citation Khan, M.A., Pervez, N., Rehman, F.U., Khan, A.G., Hashim, M., Bari, S.A., Qadeer, A., Kakar, S.U. (2024). Reversibility of complete heart block after acute anterior wall MI. *Biol. Clin. Sci. Res. J.*, **2024***: 1131*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1131]

Patients aged 18-65 years. Patients with confirmed diagnosis of AMI based on electrocardiographic (ECG) findings, cardiac enzyme levels (e.g., troponin I or T), and clinical presentation (e.g., chest pain, syncope). Patients with documented atrioventricular (AV) block or complete heart block on ECG. Ptients providing informed written consent.

Patients younger than 18 years or older than 65 years. Patients with a history of previous myocardial infarction or pre-existing pacemaker implantation. Patients unable to provide informed consent due to cognitive or language barriers. Patients with incomplete medical records.

Upon presentation, each patient underwent a detailed clinical evaluation, including a full medical history and physical examination. Baseline demographic information, including age, sex, comorbid conditions (e.g., diabetes, hypertension, smoking status), and family history of ischemic heart disease (IHD), was recorded.

Patients were diagnosed with AMI based on the presence of ischemic symptoms, ST-segment elevation on ECG, or elevated cardiac biomarkers. The presence of heart block (AV block or complete heart block) was confirmed by ECG findings.

All patients underwent coronary angiography to assess the underlying ischemic etiology of their conduction disturbances. The patients were initially managed with temporary pacemaker (TPM) implantation for hemodynamic stabilization. Re-evaluation was performed two weeks later, and the decision regarding permanent pacemaker implantation was made based on the reversibility of the heart block.

The primary outcome of interest was the frequency of reversibility of complete heart block within the two-week observation period. Reversibility was defined as restoration of normal AV conduction without the need for permanent pacemaker implantation.

Secondary outcomes included the association of heart block reversibility with patient characteristics such as age, gender, comorbidities (e.g., diabetes, hypertension), smoking status, and time from symptom onset to hospital presentation.

Data were analyzed using SPSS version 22.0 (IBM Corp, Armonk, NY). Continuous variables were reported as means ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Independent t-tests were used to compare continuous variables, and chi-square tests were employed to evaluate the association between categorical variables.

Multivariate logistic regression analysis was conducted to identify independent predictors of heart block reversibility, adjusting for confounding variables such as age, gender, comorbid conditions, and smoking status. A p-value ≤ 0.05 was considered statistically significant.

The study protocol was approved by the Ethical Review Committee of Bolan Medical Complex, Quetta (Approval No: BMC/IRB/022). Informed written consent was obtained from all participants prior to data collection. The confidentiality of patient information was ensured by de-identifying data, and the study complied with the ethical standards of human research outlined by the Declaration of Helsinki.

Results

A total of 100 patients diagnosed with acute myocardial infarction (AMI) and concurrent heart block were included in the study. The mean age of the study participants was 52.5 ± 14.8 years, ranging from 19 to 65 years. Of the total population, 60 (60%) were male, and 40 (40%) were female. The majority of patients had at least one comorbid condition. Diabetes mellitus was present in 40% of the patients, while 55% had hypertension, and 43% were smokers. Additionally, 30% of the patients had a family history of ischemic heart disease (IHD), and 33% were diagnosed with dyslipidemia. Table 1 summarizes the baseline demographic and clinical characteristics of the participants.

Table 1: Baseline Demographic and Clinical Characteristics of Patients (N = 100)

Variable	Frequency (n)	Percentage (%)
Age (years)		
Mean ± SD	52.5 ± 14.8	
Range	19-65	
Gender		
Male	60	60%
Female	40	40%
Diabetes Mellitus		
Yes	40	40%
No	60	60%
Hypertension		
Yes	55	55%
No	45	45%
Smoking Status		
Yes	43	43%
No	57	57%
Family History of IHD		
Yes	30	30%
No	70	70%
Dyslipidemia		
Yes	33	33%
No	67	67%

Among the 100 patients, 45 (45%) had a reversible complete heart block, while 55 (55%) required permanent pacemaker implantation due to persistent heart block. The mean duration of temporary pacemaker dependence was 12 ± 3.4 days. Patients who showed heart block reversibility typically presented with inferior wall myocardial infarction, and reversibility was observed more frequently in patients without underlying comorbidities such as diabetes and hypertension ($p < 0.05$). (Table 2).

The duration of temporary pacemaker (TPM) use was evaluated among the patients. Those with reversible complete heart block had a significantly shorter duration of TPM dependence compared to those who required permanent pacemaker implantation. The mean duration for reversible cases was 10.3 ± 2.1 days, whereas it was 13.4 ± 3.8 days for non-reversible cases ($p < 0.001$). (Table 3)

Multivariate logistic regression analysis revealed that the presence of diabetes mellitus ($p = 0.01$), hypertension ($p = 0.04$), and anterior wall MI ($p = 0.03$) were independent predictors of non-reversibility of heart block. In contrast,

[Citation Khan, M.A., Pervez, N., Rehman, F.U., Khan, A.G., Hashim, M., Bari, S.A., Qadeer, A., Kakar, S.U. (2024). Reversibility of complete heart block after acute anterior wall MI. *Biol. Clin. Sci. Res. J.*, **2024***: 1131*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1131]

patients with inferior wall MI had a higher likelihood of heart block reversibility (p = 0.03). (Table 4)

Table 2: Reversibility of Complete Heart Block in Patients with AMI (N = 100)

Variable	Reversible (n = 45)	Non-Reversible (n = 55)	p-value
Age (years, Mean ± SD)	50.2 ± 13.6	54.1 ± 15.1	0.07
Gender			
Male	28 (62%)	32 (58%)	0.75
Female	17 (38%)	23 (42%)	0.75
Diabetes Mellitus			
Yes	12 (27%)	28 (51%)	0.01
No	33 (73%)	27 (49%)	0.01
Hypertension			
Yes	20 (44%)	35 (64%)	0.04
No	25 (56%)	20 (36%)	0.04
Smoking Status			
Yes	18 (40%)	25 (45%)	0.65
No	27 (60%)	30 (55%)	0.65
Dyslipidemia			
Yes	12 (27%)	21 (38%)	0.23
No	33 (73%)	34 (62%)	0.23
Type of MI			
Inferior Wall MI	30 (67%)	25 (45%)	0.03
Anterior Wall MI	15 (33%)	30 (55%)	0.03

Table 3: Duration of Temporary Pacemaker Use in Patients with AMI

Variable	Reversible (n = 45)	Non-Reversible (n = 55)	p-value
Duration of TPM use (days)	10.3 ± 2.1	13.4 ± 3.8	< 0.001

Table 4: Multivariate Logistic Regression Analysis of Factors Associated with Non-Reversibility of Complete Heart Block

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (years)	1.02	0.98 – 1.06	0.15
Male Gender	0.85	0.45 – 1.61	0.65
Diabetes Mellitus	2.72	1.25 – 5.94	0.01*
Hypertension	1.89	1.02 – 3.49	0.04*
Smoking	1.15	0.59 – 2.26	0.68
Dyslipidemia	1.49	0.73 – 3.05	0.25
Anterior Wall MI	2.35	1.11 – 4.96	0.03*

Discussion

The present study aimed to assess the frequency of complete heart block reversibility in patients with acute myocardial infarction (AMI) and to identify clinical predictors of reversibility. We found that 45% of the patients experienced reversible heart block, which is consistent with the findings reported in earlier studies. Moreover, our logistic regression analysis revealed that diabetes, hypertension, and anterior wall MI were significant predictors of non-reversibility, while inferior wall MI was associated with a higher likelihood of reversibility.

The frequency of heart block reversibility in our study is comparable to the rates reported in previous studies. For instance, Harikrishnan et al. (2015) observed that approximately 50% of patients with complete heart block secondary to AMI experienced resolution within 48-72 hours of medical management, especially in those with inferior wall MI (8). Our results similarly demonstrated that patients with inferior wall MI were significantly more likely to have reversible heart block, with an odds ratio (OR) of 0.43 (p = 0.03). This supports the notion that transient ischemia at the atrioventricular (AV) node, as seen in inferior wall MI, is more likely to resolve spontaneously following reperfusion or medical therapy.

In contrast, anterior wall MI has been consistently associated with a higher risk of non-reversible heart block due to the extensive septal necrosis that often affects the bundle branches. Our study corroborates this association, with an odds ratio of 2.35 for non-reversibility in patients with anterior wall MI (p = 0.03). Similar findings were reported by Kosmidou et al. (2017), who found that anterior wall MI patients had a significantly higher rate of persistent AV block, often requiring permanent pacemaker implantation. This is attributed to the more severe myocardial damage and involvement of the conduction system in anterior infarctions (9).

Diabetes mellitus was another significant predictor of non-reversibility in our study, with diabetic patients being 2.72 times more likely to have persistent heart block (p = 0.01).

[Citation Khan, M.A., Pervez, N., Rehman, F.U., Khan, A.G., Hashim, M., Bari, S.A., Qadeer, A., Kakar, S.U. (2024). Reversibility of complete heart block after acute anterior wall MI. *Biol. Clin. Sci. Res. J.*, **2024***: 1131*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1131]

This aligns with the work of Nguyen et al. (2008), who identified diabetes as an independent risk factor for poor recovery from conduction disturbances in AMI patients. The underlying mechanisms may involve the detrimental effects of chronic hyperglycemia on microvascular circulation and the AV nodal tissue, resulting in delayed recovery of conduction (10).

Hypertension also emerged as a predictor of non-reversible heart block in our cohort (OR = 1.89, p = 0.04). Previous studies have indicated that long-standing hypertension leads to structural and functional changes in the myocardium, which can exacerbate the severity of myocardial infarction and the likelihood of conduction system damage (Meine et al., 2005) (11). Our results are in agreement with these findings, underscoring the need for early and aggressive management of hypertension in AMI patients to mitigate adverse outcomes, including heart block.

Interestingly, smoking was not found to be a significant predictor of heart block reversibility in our study (p = 0.68). This contrasts with some earlier studies, such as Sundhu et al. (2017), which suggested that smoking exacerbates myocardial ischemia and may contribute to the persistence of conduction disturbances. However, the lack of statistical significance in our analysis could be attributed to the relatively small sample size, limiting the study's power to detect an effect (12).

The findings of our study have important clinical implications for the management of complete heart block in patients with AMI. Our data suggest that patients with inferior wall MI, particularly those without comorbid conditions such as diabetes or hypertension, are more likely to experience spontaneous resolution of heart block. Therefore, in these patients, delaying permanent pacemaker implantation while providing temporary pacemaker support may be a reasonable approach. On the other hand, patients with anterior wall MI or significant comorbidities may require earlier consideration of permanent pacemaker therapy, as their likelihood of reversibility is lower.

Several limitations should be acknowledged in our study. First, this was a single-center study conducted at Bolan Medical Complex, Quetta, which may limit the generalizability of our findings. Larger, multi-center studies are needed to validate our results. Additionally, while we used a consecutive sampling method, selection bias cannot be entirely excluded. Finally, we did not evaluate long-term outcomes, such as mortality or recurrent heart block, which could provide a more comprehensive understanding of the clinical implications of heart block reversibility in AMI patients.

Conclusion

In conclusion, our study demonstrates that approximately 45% of patients with complete heart block in the setting of acute myocardial infarction experience reversibility, particularly those with inferior wall MI. Diabetes, hypertension, and anterior wall MI were significant predictors of non-reversibility, indicating that these patients may benefit from earlier consideration of permanent pacemaker implantation. These findings highlight the importance of individualized patient management based on clinical characteristics and infarct location. Further studies are warranted to explore the long-term outcomes associated with heart block reversibility in AMI patients

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department Concerned. (IRBEC-TCHISB-992/22)

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MUHAMMAD AFZAL KHAN
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.
NOMAN PERVEZ
Coordination of collaborative efforts.
FAZAL UR REHMAN
Study Design, Review of Literature.
ABDUL GHAFFAR KHAN
Conception of Study, Final approval of manuscript.
MUHAMMAD HASHIM
Manuscript revisions, critical input.
SAYED ABDUL BARI
Manuscript drafting.
ASMA QADEER
Coordination of collaborative efforts.
SANA ULLAH KAKAR
Data entry and Data analysis, drafting article.

References

1. Fawaz, A., Nasreddine, W., Makke, Y., Atweh, S., Wazne, J., Arabi, M., et al. (2014). Association of cardiovascular risk factors and troponin elevation after generalized tonic-clonic seizures. Seizure - European Journal of Epilepsy, 23(2), 146–150.
2. Harikrishnan, P., Gupta, T., Palaniswamy, C., Kolte, D., Khera, S., Mujib, M., Aronow, W. S., et al. (2015). Incidence and outcomes of high-degree atrioventricular block complicating acute myocardial infarction. JACC: Clinical Electrophysiology, 1(6), 529-538. https://doi.org/10.1016/j.jacep.2015.07.013
3. Kosmidou, I., Redfors, B., Dordi, R., Dizon, J. M., McAndrew, T., Mehran, R., Ben-Yehuda, O., et al. (2017). Incidence, predictors, and outcomes of high-grade atrioventricular block in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention (from the HORIZONS-AMI trial). American Journal of Cardiology, 119(9), 1295-1301. https://doi.org/10.1016/j.amjcard.2017.01.043
4. Meine, T. J., Al-Khatib, S. M., Alexander, J. H., Granger, C. B., White, H. D., Kilaru, R., et al. (2005). Incidence, predictors, and outcomes of high-degree atrioventricular block complicating acute myocardial infarction treated with thrombolytic therapy. American

Heart Journal, 150(4), 670-674. https://doi.org/10.1016/j.ahj.2004.10.027
5. Nguyen, H. L., Lessard, D., Spencer, F. A., Yarzebski, J., Zevallos, J. C., Gore, J. M., et al. (2008). Thirty-year trends (1975-2005) in the magnitude and hospital death rates associated with complete heart block in patients with acute myocardial infarction: A population-based perspective. American Heart Journal, 156(2), 227-233. https://doi.org/10.1016/j.ahj.2008.03.010
6. Sundhu, M., Yildiz, M., Syed, M., Shah, B., Gul, S., Afzal, O., et al. (2017). Clinical characteristics and outcomes of patients with ischemic and non-ischemic complete heart block. Cureus, 9(5). https://doi.org/10.7759/cureus.1199
7. Harikrishnan, P., Gupta, T., Palaniswamy, C., Kolte, D., Khera, S., Mujib, M., Aronow, W. S., et al. (2015). Incidence and outcomes of high-degree atrioventricular block complicating acute myocardial infarction. *JACC: Clinical Electrophysiology*, 1(6), 529-538. https://doi.org/10.1016/j.jacep.2015.07.013
8. Kosmidou, I., Redfors, B., Dordi, R., Dizon, J. M., McAndrew, T., Mehran, R., Ben-Yehuda, O., et al. (2017). Incidence, predictors, and outcomes of high-grade atrioventricular block in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention (from the HORIZONS-AMI trial). *American Journal of Cardiology*, 119(9), 1295-1301. https://doi.org/10.1016/j.amjcard.2017.01.043
9. Meine, T. J., Al-Khatib, S. M., Alexander, J. H., Granger, C. B., White, H. D., Kilaru, R., et al. (2005). Incidence, predictors, and outcomes of high-degree atrioventricular block complicating acute myocardial infarction treated with thrombolytic therapy. *American Heart Journal*, 150(4), 670-674. https://doi.org/10.1016/j.ahj.2004.10.027
10. Nguyen, H. L., Lessard, D., Spencer, F. A., Yarzebski, J., Zevallos, J. C., Gore, J. M., et al. (2008). Thirty-year trends (1975-2005) in the magnitude and hospital death rates associated with complete heart block in patients with acute myocardial infarction: A population-based perspective. *American Heart Journal*, 156(2), 227-233. https://doi.org/10.1016/j.ahj.2008.03.010
11. Sundhu, M., Yildiz, M., Syed, M., Shah, B., Gul, S., Afzal, O., et al. (2017). Clinical characteristics and outcomes of patients with ischemic and non-ischemic complete heart block. *Cureus*, 9(5). https://doi.org/10.7759/cureus.1199

[Citation Khan, M.A., Pervez, N., Rehman, F.U., Khan, A.G., Hashim, M., Bari, S.A., Qadeer, A., Kakar, S.U. (2024). Reversibility of complete heart block after acute anterior wall MI. *Biol. Clin. Sci. Res. J.*, **2024***: 1131*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1131]